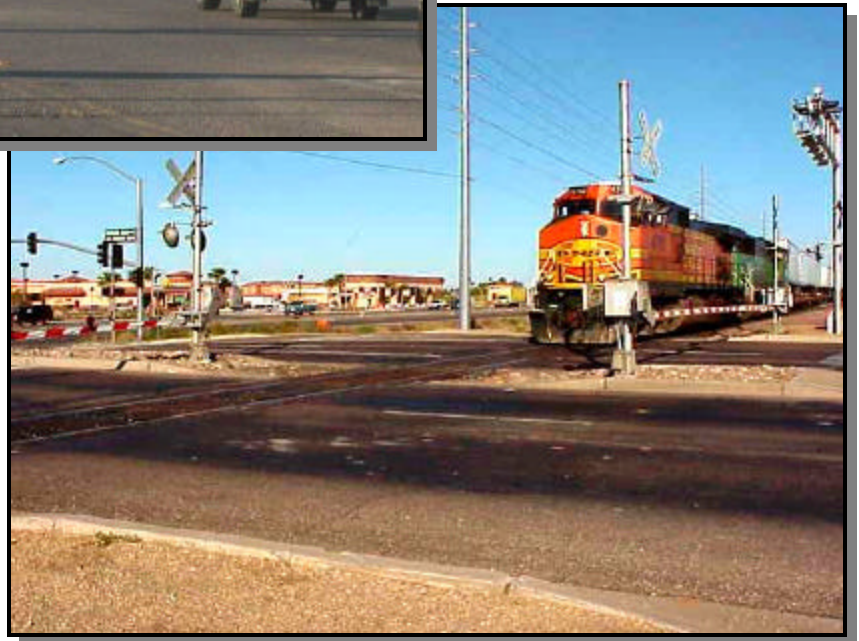


Maricopa County Department of Transportation

2003 Safety Management System Report



Transportation Planning Division
Program & Systems Analysis

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SAFETY MANAGEMENT SYSTEM OVERVIEW AND BACKGROUND

Purpose of the SMS

The County Safety Management System (SMS) is a systematic process that has the goal of reducing the number and severity of traffic accidents through improving the physical conditions of roadway segments and specific intersections. The SMS is primarily a tool for identifying, analyzing, implementing, and evaluating traffic safety on MCDOT's roadways. The SMS is also intended to provide guidance to MCDOT staff, the Transportation Advisory Board, and the Board of Supervisors in selecting, recommending, and implementing effective roadway safety strategies and projects.

LAWS AND POLICIES AFFECTING THE SMS

The County Transportation System Plan (TSP) and the Transportation Element of the Comprehensive Plan have the overriding goal to "Provide an efficient, cost effective, integrated, accessible, environmentally sensitive, and safe County-wide multi-modal system that addresses existing and future roadway networks and promotes transit, bikeways, and pedestrian travel." Reducing the accident potential and severity of accidents is one of eight objectives outlined in the Comprehensive Plan.

To carry out, measure, and manage the TSP the plan recommends implementing four transportation management systems for safety, congestion, pavement rehabilitation, and bridges. Each will help to plan and program future roadway improvement projects. The SMS described in the TSP is as follows:

"The SMS is intended to reduce the number and severity of traffic crashes. Traffic crash information including the type location, and rate of crashes is produced for all County roadway segments and intersections. The SMS will help identify ways to improve highway safety. The County will evaluate safety in all phases of highway planning, design, construction, maintenance, and operations. Maricopa County will also use the data for selecting and using effective future highway safety strategies and projects."

All four County management systems have been patterned after those originally described in the original Federal Surface Transportation Efficiency Act of 1991 (ISTEA). Reflecting the importance of safety throughout all surface transportation programs, the Federal Transportation Equity Act for the 21st Century (TEA-21) designated "the safety and security of the transportation system for motorized and non-motorized users" as one of the seven established areas to be considered in the overall planning process, both at the metropolitan and statewide level.

SAFETY IMPROVEMENT PROJECT ACCOMPLISHMENTS FOR FY 2002

- 31 projects were completed.

- 23 safety projects were started in 2002, and were still underway as of June 30, 2002.
- \$1,408,234 was spent by both the Traffic Engineering And Operations Branches on safety projects.
- Thirteen additional projects were identified for safety improvements in FY 2003.

ROLE OF THE SMS IN TRANSPORTATION IMPROVEMENTS PROGRAMMING

Safety improvement projects, primarily intersection-related, are identified through the SMS and ranked by the MCDOT Traffic Engineering branch of the Engineering Division. Traffic Engineering then makes project recommendations for inclusion in the TIP to the MCDOT Planning Division. A list of ranked projects is subsequently submitted to the TIP Review Committee and the Project Review Committee (PRC). The programming process continues as PRC project recommendations are forwarded to the Transportation Advisory Board (TAB) who in turn recommends a final list of projects to the county Board of Supervisors for funding.

The MCDOT Traffic Engineering branch along with the Construction and Operations Division has a goal to spend approximately \$500,000 per year on safety improvement projects. The process has already been in place for approximately four years with the use of databases from accidents and public complaints.

Each year, a priority list of intersections for improvements is developed through the Continuous Reduction of Accidents for Safer Highways (CRASH) program and analyzed for safety and/or capacity improvements and presented to MCDOT Transportation Planning Division.

For fiscal year 2002, ending June 30, 2002, the Traffic Engineering branch has compiled a list of safety improvement projects with some carryovers from FY 2001. Some projects were generated from customer complaints, and some from a new federal safety standard relating to guardrails. When the cost of constructing these safety improvements is below \$50,000, in-house resources are used. If the cost is above \$50,000 the projects may be recommended for consideration in the County's TIP.

MCDOT SAFETY IMPROVEMENTS FOR 2002

MCDOT Traffic Engineering and Traffic Operations completed 31 projects in FY 2002 totaling \$1,408,234.00, these included 19 programmed and 12 un-programmed projects. Twenty-three projects were started in FY 2002 and are currently underway. An additional 13 are new projects scheduled to begin in FY 2003.

Table 1: Safety Projects Completed in FY 2002

Location	Project	Cost
Aguila Road / Wickenburg & Vulture Mine Road	Geometric Improvements	\$5,988
Alsup Avenue: Camelback Road - Maryland Avenue	Guardrail	\$20,219
Bell Road & 99th Avenue	Geometric Improvements	\$5,726
Bell Road & Boswell Blvd.	Signal Update	\$5,495
Brown Road & Ellsworth Road	Traffic Signals	\$117,694
Bush Highway & Waterusers Rec. Area	Geometric Improvements	\$11,880
Camelback Road & Sarival Avenue	4-Way Stop	\$4,200
Chandler Hgts. Road & Hawes Road	4-Way Stop	\$4,200
Crismon Road & Adobe Road	4-Way Stop	\$4,200
Dobbins Road @ Laveen School	Geometric Improvements	\$3,308
Dove Valley Road: 64th Street - 68th Street	Geometric Improvements	\$923
Dynamite Boulevard & 52nd Street	Geometric Improvements	\$19,222
Elliot Road & Ellsworth Road	New Signal	\$106,227
Germann Road & Higley Road	4-Way Stop	\$4,200
Guadalupe Road & Power Road	Signal Update	\$17,310
Higley Road: Hunt Highway - Stacey Road	Guardrail	\$75,138
Joy Ranch Road & 7th Street	4-Way Stop	\$4,200
Kachina Road & Deer Trail Road	4-Way Stop	\$4,200
Loop 303 & Indian School Road	Geometric Improvements	\$608,108
Meeker Blvd.: Grand Avenue to R.H. Johnson Blvd.	Geometric Improvements	\$68,896
Northern Avenue & 107th Avenue	Geometric Improvements	\$3,455
Olive Avenue & 111th Avenue	New Signal	\$115,150
Olive Avenue & El Mirage Road	New Signal	\$96,601
Peoria Avenue & 99th Avenue	Geometric Improvements	\$4,009
Power Road n/o Williams Field Road	Geometric Improvements	\$23,350
Queen Creek Road & Power Road	4-Way Stop	\$4,200
R.H. Johnson Blvd. & 151st Avenue	New Signal	\$37,692
Riggs Road & Alma School Road	Signal Update	\$18,540
Riggs Road & Sossaman Road	4-Way Stop	\$4,200
Van Buren Street & Sarival Avenue	4-Way Stop	\$4,200
Via De Palmas: McQueen Road - 122nd Street	Geometric Improvements	\$5,503
	Total	\$1,408,234

Table 2: Safety Projects Scheduled to Start in FY 2002 and FY 2003.

Projects Scheduled to Start in FY 2002	
Location	Project
27th Ave.: Estrella Ave. - Photo View Rd.	Roadway
90th Street: McDowell Road to Quenton Street	Roadway
Acoma Drive: 79th Avenue - 75th Avenue	Traffic Calming
Alma School Road & Champagne	New Signal
Bell Road & 98th Avenue	Signal Update
Broadway Road & Ellsworth Road	Signal Update
Bush Highway: 7 Locations	Guardrail
Carefee Highway & 56th Street	New Signal
Crismon Road .5 mile north of Brown Road	Guardrail
Ellsworth Road & Coralbell Avenue	New Signal
Happy Valley Road & 67th Avenue	New Signal
Loop 303 & Northern Avenue	Roadway
Loop 303 & Olive Avenue	Roadway
M.C. 85 & 83rd Avenue	Signal Update
McDowell Mtn. Park Pay Station	Roadway
McDowell Mtn. Rd. & McDowell Mtn. Park Dr.	Roadway
Old U.S. 80 .5 miles n/o Desert Rose Road	Guardrail
Olive Avenue & 103rd Avenue	Signal Update
Southern Avenue & Ellsworth Road	Signal Update
Thomas Road: Cotton Lane to Loop 303	Roadway
Union Hills Drive & 107th Avenue	New Signal
Williams Field Road & Lindsay Road	New Signal
Williams Field Road & Val Vista Drive	New Signal
Projects Scheduled to Start in FY 2003	
Anthem Way & Gavilan Peak Parkway	New Signal
Bartlett Dam Road to Horseshoe Dam Road	Guardrail
Beardsley Road & 99th Ave / Lake Pleasant Road	New Signal
Broadway Road & Litchfield Road	Roadway
Cloud Road: 29th Avenue - 27th Avenue	Guardrail
Dixileta Drive & 56th Street	Roadway
Fort McDowell Road & Mohave Road	Guardrail
New River Road: 33rd Avenue to Mano Drive	Guardrail
Queen Creek Road & Power Road	New Signal
Rittenhouse Road & Power Road	Roadway
Seven Springs Road: MP 1.75 0 4.4	Guardrail
Union Hills Drive: 107th Avenue to 99th Avenue	Roadway
Waddell Road & Dysart Road	New Signal

EVALUATION OF SAFETY

MCDOT is continuing their ongoing process of reviewing locations that are exhibiting potential safety issue problems. The initial step is to examine the number accidents, accident rates, and the type of crashes occurring on Maricopa County's maintained roadways and intersections. Further investigation includes evaluating traffic volumes, injury severity, background and geometric aspects of the accident locations. After all the initial aspects of the accident locations are assessed, a list is formed for an in-depth review.

Procedures Used for Identifying and Ranking Low Cost Intersection Safety Improvements

The intersection crash rate has been adopted by the County as the measure of effectiveness in evaluating intersection safety. Through the County's managing for results, intersection crash rates are used to track how well the spending of MCDOT funds improves intersection safety.

The CRASH program uses intersection crash rates as a beginning point in an annual program for spot safety improvements. This program emphasizes relatively inexpensive system improvements for County roads having high crash experience. The first benchmark is an intersection accident history of four or more crashes in any one of the last three years. This benchmark has proven to be a good indication of possible problems and warrants further detailed analysis.

The CRASH program looks at four categories; number of crashes, type of crash, crash rates and traffic volumes. High accident location identification worksheets are compiled and a list of intersections is generated for further review. After analysis, Traffic Engineering ranks those high crash intersections that justify improvements.

Safety Analysis Used in Fiscal Year 2002

All the intersections within the County that have experienced four or more accidents in any one year during the last three years were selected as potential candidates for safety improvements. These intersections were further evaluated based on crash rates, traffic volumes, whether there has been some kind of a traffic control change in the previous three years, and finally public complaints. The accident rate of each intersection was calculated using the following relationship. (Accident Rate = Accidents per Million Vehicles Entering the Intersection per Year)

$$\text{Intersection Accident Rate} = \frac{(\text{No. of accidents experienced in the last three Years}) \times 10^6}{(\text{Combined Average Daily Traffic}) \times (1095 \text{ days})}$$

Analysis Steps Used in Fiscal Year 2002

1. All intersections within the County that experienced four or more accidents in any one year during the last three years (1999–2001) were selected as potential candidates for safety improvements.
1. A database was created by the Traffic Engineering Section of MCDOT to group accidents according to number and rate per intersection. The average accident rate for all signalized intersections within Maricopa County was 0.60. From the accident database, the total number of accidents and accident rates for those intersections with four or more accidents in any one-year during the last three years was calculated.
2. Each intersection is given a score on the basis of accident rate, total accidents experienced per year [averaged over the last three years (1999–2001), and whether or not the intersection control has been evaluated in the past year or not.
1. The intersections were ranked in descending order based on their scores. The resulting priority list was used for analyzing safety improvements.
1. Complaints received from the public regarding the operation of intersections influenced the ranking of specific intersections in the priority list. County Traffic Engineering has a database on traffic complaints, and information for the previous three years was compiled for input in the intersection list.
1. From the public complaint database, intersections were ranked in the order of the number of complaints received. An initial screening was conducted on the background of each complaint and if safety issues are involved. These intersections were then moved into the final list of eligible intersections.

Planned Safety Improvement Projects for Fiscal Year 2003

Looking ahead to fiscal year 2003, the Traffic Engineering branch has identified 36 safety improvement projects to be completed with in-house resources. The Traffic Engineering and the Operations branches have a combined goal to spend \$500,000.00 for safety improvement projects per year. Both branches will attempt to complete the 23 projects that were started in FY 2002 and the thirteen new projects which are identified in Table 2. The scoring methodology used each year is not a factor in determining the projects displayed in Table 2; hence, the projects are not prioritized.

In addition, guardrail projects were added to comply with a new Federal Highway Administration (FHWA) standard. The standard requires upgrades to existing guardrails especially end treatments and the implementation of new guardrails to enhance roadway safety.

ADDITIONAL SAFETY EVALUATION PARAMETERS

In addition to identifying safety problems at intersections, a preliminary analysis has identified other potential safety hazard areas. This analysis based on the accident database from the Arizona Department of Transportation's Motor Vehicle Division reveals some interesting trends between accidents occurring in the incorporated cities and towns in the County and the unincorporated portions of the County.

Accident System Identification Surveillance System (ALISS)

The Arizona Department of Transportation (ADOT) Motor Vehicle Division provides the ALISS database containing all accidents in the State of Arizona to all local governmental agencies. The ALISS data set used for this SMS covered the period of January 1, 1999, through December 31, 2001. Maricopa County's share of accidents equals 253,901 for this period. These include all accidents occurring in both cities and towns and the unincorporated portions of the County. On County owned roads within the unincorporated portion of the County there were 8,514 accidents for the three year period.

Analysis/Tools

To properly analyze the accident situation in Maricopa County's jurisdiction the following tools have been developed:

- Standardized data collection
- Geographic Information system

To accomplish the task of establishing an effective safety management system MCDOT uses an inventory of all roadway segments. The ownership of these road segments includes Maricopa County plus all other roads belonging to the cities, towns, and other governmental agencies in the Phoenix Metropolitan area. These roads are kept in a standardized, interchangeable format.

CRASH STATISTICS FOR 1999-2001

The total number of crashes, the crash rate, and the injury severity of crashes in the unincorporated portions of the County has declined for the past three years. Table 3 shows the total number of crashes each year, the total number of people involved, and the estimated cost to the public. This cost reflects the estimated level of expenditure by a public agency that would be necessary to statistically reduce the number of the various types of injuries by a significant amount. The cost figures are used primarily to compare various types of crashes.

The costs used for various types of injury severity are as follows: Fatal \$3 million, Incapacitating \$481,533, Non-incapacitating \$45,000, Possible Injury \$12,454, all

other injuries or non injuries are calculated at \$6,000 per crash.

When viewing crash statistics it should be remembered that in almost all crashes there are many more people are involved than just the vehicle driver. To put this into perspective, while there were 8,514 crashes in the County in the last three years. These involved 22,891 people. This equates to 6% of the entire population of the unincorporated portion of the County. This means that 16 out of every 100 people in the County were involved either as a driver, passenger, pedestrian, bicyclist, or just an unlucky bystander in a traffic crash in the last three years. These crashes had an estimated public cost of 2.3 billion dollars.

For all reported crashes that occurred in the last three years in the County, including all cities and towns, there were 745,314 people involved. This equates to 22.5% of the population of the entire metropolitan region. What this means is that more than one out of every five people in the metropolitan region were involved in some capac-

Table 3: Total County Crashes, Cost of Crashes, and People Involved 1999-2001

Year	Number of Crashes	Public Cost of Crashes	People Involved
1999	3,188	\$946,405,731	8,533
2000	2,985	\$751,819,538	7,972
2001	2,341	\$613,209,317	6,386
Totals	8,514	\$2,311,434,586	22,891

ity in traffic crashes during the last three years. The estimated public cost of these crashes exceeded 36 billion dollars.

Not only the number but the average severity of traffic crashes in the unincorporated County has declined during the past three years. Table 4 shows crashes in the

Table 4: County Crashes by Injury Severity for 1999-2001

Injury Severity	Number of Crashes	Public Cost of Crashes	People Involved
Fatal	139	\$1,188,000,000	396
Incapacitating	588	\$822,458,364	1,708
Non-incapacitating	1,331	\$172,890,000	3,842
No Injury	4,765	\$75,018,000	12,503
Possible Injury	1,376	\$50,974,222	4,093
Unknown	234	\$1,530,000	255
Not Reported	81	\$564,000	94
Totals	8,514	\$2,311,434,586	22,891

County by injury severity for 1999-2001. Several factors that may be influencing the reduction in crash severity include upgrading high crash rate intersections through the County's CRASH program, cities and towns annexing County roadways, and traffic reductions on some high volume roadways due to new freeway openings.

In an effort to better understand the nature of traffic crashes in the County, Table 5 shows what vehicles are crashing into, the total number of people involved in these type crashes and the estimated public cost. Crashes with other motor vehicles accounts for 70% of all incidents. This is followed by crashes with fixed objects (6%), overturning of a vehicle (5%), and then hitting parked vehicles (3%). The collision manner, people affected and the public costs associated with County crashes are

Table 5: County Crashes with Objects, People Involved, and Costs

Crashes With:	Number of Crashes	People Involved	Public Cost of Crashes
Other motor vehicles	5,964	18,762	\$1,615,015,529
Other fixed objects	504	756	\$74,815,888
Overturning	392	722	\$284,597,905
Motor vehicles parked properly	247	302	\$4,707,666
All other non collision	192	278	\$29,933,097
Curbs	148	250	\$37,774,523
Fences	134	197	\$15,030,259
Utility poles	109	179	\$23,497,010
Trees	105	153	\$12,155,253
Bicyclists	96	223	\$46,593,683
Animal livestock	96	192	\$6,080,258
Traffic signs	80	107	\$4,379,817
Pedestrians	75	174	\$98,037,033
Breakage of vehicle	38	66	\$3,442,843
Wild game	38	68	\$466,362
Spec devices	31	42	\$3,447,454
Traffic barricades	29	45	\$523,362
Guard rails	28	44	\$3,187,389
Luminaires (Street Lights)	27	29	\$3,734,165
Object dropped from vehicle	25	51	\$540,000
Animal pets	21	25	\$1,263,520
Fire in vehicle	19	26	\$175,362
Motor vehicle parked improperly	16	41	\$5,092,238
Traffic signals	16	25	\$435,908
Boulders	12	17	\$147,454
Unknown	11	12	\$3,664,987
Other non-fixed objects	11	14	\$598,533
Occupant fall from vehicle	8	16	\$26,106,132
Wild animals	8	13	\$156,000
Bridge culverts	7	14	\$213,632
Fallen tree or stone	5	10	\$222,454
Object falling from vehicle	5	5	\$69,000
Median barriers	5	7	\$67,816
Pedestrian conveyances	4	9	\$1,212,974
Animal with person	3	10	\$3,942,264
Exhaust fume poisoning	2	4	\$82,362
Train, forward	2	2	\$18,454
Machine transports	1	1	\$6,000
Totals	8,514	22,891	\$2,311,434,586

shown in Table 6. The single vehicle crash is the most prevalent type crash followed by angle crashes. In the cities and towns in the region the rear-end crash is always the most frequent. In both the County and the cities and towns head-on crashes are the most costly with respect to dollars and human life.

Table 6: Collision Manner, Cost, and People Involved for County Crashes

Collision manner	Number of Crashes	Public Cost of Crashes	People Involved
Single Vehicle	2,469	\$629,641,446	3,864
Angle	2,062	\$610,180,860	6,352
Rear-End	1,834	\$270,132,747	5,994
Left Turn	690	\$202,890,299	2,127
Sideswipe (same)	684	\$100,483,312	2,052
Other	190	\$86,921,727	620
Backing	184	\$3,306,080	510
U-Turn	177	\$52,956,884	622
Sideswipe (opposite)	113	\$46,698,350	363
Head-On	88	\$305,047,841	320
Non-Contact (not mc)	21	\$2,121,974	63
Non-Contact (mc)	2	\$1,053,066	4
Totals	8,514	\$2,311,434,586	22,891

Overall County Crash Rates

While calculating crash rates for roadway segments and intersections provides a good indicator of potential problem locations, an indicator is also needed that describes the accident history of the entire County roadway system. This factor is needed so that progress towards making the County's roadways safer can be measured over time. The overall County crash rate was selected. This measures the number of crashes per million vehicle miles of travel (VMT), per mile of County owned roadway, per year.

The crash rates and the total number of crashes shown in Table 7 show a significant downward trend over the past four years for County roadways. While the trend is steadily downward, why it is occurring can not be absolutely determined. It is probably the result of several factors including

- Making safety improvements to many high crash rate intersections through the MCDOT's CRASH program.
- Reductions of County roadway mileage through annexations by the cities and towns.
- ADOT opening new freeway segments which typically divert significant amounts of traffic off parallel MCDOT roadways thus eliminating many crashes.
- More accurate data collection by the State.

Table 7: County Crash Statistics 1998-2001

Factors	1998 Data	1998 Rate	1999 Data	1999 Rate	2000 Data	2000 Rate	2001 Data	2001 Rate
Miles of County Owned Roads That Have traffic Counts	1,592	1.65*	1,729	1.58*	1,719	1.45*	1,690	1.06
Total County Road Miles	2,822		2,768		2,719		2,680	
VMT/Day	2,885,592		3,453,031		3,558,490		3,818,639	
VMT/Mile/Day	1,812		1,997		2,070		2,260	
Crashes	3,085		3,188		2,985		2,341	
% of the Network Counted	55.2%		62.4%		63.4%		63.1%	

*These rates were adjusted from the 2001 SMS report due to more accurate data and calculations.

It is very encouraging that the crash rate in the County has been declining for the past four years despite an increase in the vehicle miles of travel on the remaining County roadways. MCDOT will continue to monitor this trend in future years